B.Sc. Part-III (Semester-VI) Examination

CHEMISTRY

Time : Three Hours] [Maximum Marks : 80

Note :— (1) **ALL** questions are compulsory.

(2) Question No. **1** carries **8** marks while each of the remaining **SIX** questions carries **12** marks.

(3) Draw diagrams and write equations wherever necessary.

(4) Use of scientific calculators is allowed.

1. (A) Fill in the blanks :

(i) According to quantum theory, the radiations consist of packets of energy called _____.

(ii) The range of finger print region is _____.

(iii) The elements which are absolutely necessary for life process in a very small amount are called as _____.

(iv) The complexes showing reaction within one minute, 1 M concentration and at room temperature are called as _____ complexes. 2

(B) Choose the correct alternative :

(i) The intermediate formed in SN^2 mechanism shows _____ geometry.

(a) Pentagonal (b) Trigonal

(c) Octahedral (d) Pentagonal bipyramidal

(ii) Expression for energy of a particle in one dimensional box is :

(a) $\frac{n^2h^2}{8ma^2}$ (b) $\frac{nh^2}{2ma^2}$

(c) $\frac{n^2h^2}{4ma^2}$ (d) $\frac{n^2h}{2ma^2}$

(iii) Number of NMR signals in propane is :

(a) Four (b) Three

(c) Two (d) One

(iv) Geometrical shape of $Cr(CO)_6$ molecule is :

(a) Linear (b) Octahedral

(c) Tetrahedral (d) Pentagonal bipyramidal 2

(C) Answer in ONE sentence 4

(i) Define the term auxochrome.

(ii) What are phosphonitrilic polymers ?

(iii) What is Compton effect ?

(iv) What is potentiometric titration ?

UNIT—I

2. (a) Describe the procedure of colourimetric determination of concentration of Cu^{2+} ions. 4

(b) Explain SN^1-dissociative mechanism of substitution in octahedral complexes. 4

(c) Describe the process of descending chromatography. 4

OR

3. (p) What is Beer-Lambert's law ? Write its mechanical expression and limitations. 4

(q) Define labile and inert complexes with an example of each. 4

(r) What is paper chromatography ? Write its applications. 4

UNIT—II

4. (a) Explain the structure of $Fe(CO)_5$ molecule on the basis of valence bond theory. 4

(b) How is phosphonitrilic chloride prepared from PCl_5 and NH_4Cl ? Give its reaction with ammonia. 4

(c) Explain the role of K^+ in biological activities. 4

OR

5. (p) What is the action of following on $Ni(CO)_4$: (i) Halogen and (ii) H_2SO_4 ? 4

(q) What happens when $(PNCl_2)_3$ reacts with :

(i) Alcohol

(ii) C_6H_6 ? 4

(r) Discuss the role of Ca^{2+} in metabolic activity. 4

UNIT—III

6. (a) Calculate the vibrational degrees of freedom for the following molecules in IR spectroscopy :

(i) CO_2

(ii) NH_3

(iii) Benzene

(iv) CH_4. 4

(b) Explain the following electronic transitions with suitable example :

(i) $\pi \rightarrow \pi^*$ 2

(ii) $n \rightarrow \sigma^*$ Transition. 2

(c) Explain the following terms with diagram :

(i) Scissoring

(ii) Twisting. 4

OR

7. (p) Explain the following terms :

(i) Hypsochromic shift

(ii) Hyperchromic effect. 4

(q) Differentiate the following pairs of compounds on the basis of IR spectroscopy :

(i) acetamide and acetic acid

(ii) acetone and ethanol. 4

(r) What types of electronic transitions do you expect in each of the following compounds ?

(i) CH_4

(ii) $CH_2 = CH_2$

(iii) CH_3–Cl

(iv) CH_3–CH = O 4

UNIT—IV

8. (a) How will you distinguish following pairs by their NMR spectra ?

(i) CH_3COCH_3 and CH_3CHO

(ii) CH_3OCH_3 and CH_3CH_2-OH 4

(b) Calculate m/z value of each of the following in Mass Spectroscopy :

(i) $[(CH_3)_2CH]^+$

(ii) $[CH_3–NH_2]^+$ 4

(c) Explain the following terms with an example :

(i) Spin-spin coupling

(ii) Chemical shift. 4

OR

9. (p) Explain in brief the principle of mass spectroscopy. 4

(q) Write the NMR signals shown by following compounds :

(i) Ethyl bromide

(ii) 1, 3-dichloropropane

(iii) Ethyl acetate

(iv) Isopropyl bromide. 4

(r) Calculate m/z values for each of the following molecular ions :

(i) $[C_6H_5–CH_3]^+$

(ii) $[CH_3–CH_2–OH]^+$ 4

10. (a) Derive an expression for the energy of a free particle in one dimensional box. 4

(b) What do you understand by dual character of matter ? 4

(c) The work function of Cs metal is 2.14 eV. Calculate the kinetic energy and the speed of the electrons emitted when the metal is irradiated with light of wavelength 700 nm. 4

OR

11. (p) What is the physical significance of ψ and ψ^2 ? 4

(q) What is threshold frequency ? How is this frequency related to the work function ? 4

(r) An electron is confined in one dimensional box of width 4.0×10^{-10} m. Calculate its energy in the fourth energy level. 4

UNIT—VI

12. (a) Define :

(i) pKa of the weak acid

(ii) Concentration cell

(iii) Q-value

(iv) Nuclear fusion reactions. 4

(b) How pH of the solution is determined using the hydrogen gas electrode ? 4

(c) Explain the nuclear force on the basis of meson theory. 4

OR

13. (p) Give any four evidences in favour of Magic numbers. 4

(q) Derive an equation for EMF of concentration cell without transference. 4

(r) (i) Give any two applications of radioisotopes in industry.

(ii) Give any two advantages of glass electrode. 4